

Claims

- [c1] 1. A method for heating a battery in a vehicle having a battery heater, the method comprising:
determining a vehicle key-off condition; and
enabling energy flow from the battery to the heater to
heat the battery after determining the key-off condition.
- [c2] 2. The method of claim 1, wherein a controller enables
energy flow from the battery to the heater, the method
further comprising the step of placing the controller in a
suspend mode condition in response to the determina-
tion of the key-off condition prior to enabling energy
flow from the battery to the heater.
- [c3] 3. The method of claim 2, further comprising placing the
controller in an active mode so as to enable energy flow
from the battery to the heater for heating the battery
thereafter.
- [c4] 4. The method of claim 3, further comprising waking up
the controller from the suspend mode condition to place
it in the active mode after a predetermined period of
time after the key-off condition.

- [c5] 5. The method of claim 1, further comprising determining an ambient temperature, wherein the enabling step is performed when an ambient temperature is less than a predefined threshold.
- [c6] 6. The method of claim 1, further comprising determining a battery temperature, wherein the enabling step is performed when the battery temperature is less than a predefined threshold.
- [c7] 7. The method of claim 1, further comprising determining a battery state of charge (SOC), wherein the enabling step is performed when the battery SOC is greater than a predefined threshold.
- [c8] 8. The method of claim 7, wherein the enabling step further comprises limiting energy flow from the battery to the heater based on the battery SOC.
- [c9] 9. The method of claim 1, further comprising determining a period of time during which the key-off condition has been active, wherein the enabling step includes preventing energy flow from the battery to the heater when the key-off time period is greater than a non-use time period so as to limit battery drain when the vehicle is not in use for a prolonged period of time.
- [c10] 10. A method for heating a battery in a vehicle having a

battery heater and a vehicle system controller, the method comprising:
determining a vehicle key-off condition; and
heating the battery by enabling energy flow from the battery to the heater after the vehicle controller determines the key-off condition.

- [c11] 11. The method of claim 10, further comprising enabling energy flow from the battery to the heater if the following conditions exist:
 - a battery temperature is less than a predefined battery temperature;
 - a battery state of charge (SOC) is greater than a battery threshold SOC; and
 - a predefined non-use period of time has not elapsed since determining the key-off condition.
- [c12] 12. The method of claim 11, further comprising placing the controller in a sleep mode condition in response to determining key-off and subsequently waking up the controller to determine whether the conditions for heating the battery exist.
- [c13] 13. A battery heating system for a vehicle, the system comprising:
 - a heater for heating the battery; and
 - a controller for determining a vehicle key-off condition,

the controller enabling energy flow from the battery to the heater to heat the battery after determining the key-off condition.

- [c14] 14. The system of claim 13, wherein the controller is placed in a sleep mode condition in response to determining the key-off condition and prior to heating the battery.
- [c15] 15. The system of claim 14, wherein the controller is placed in an active mode condition to enable energy flow from the battery to the heater.
- [c16] 16. The system of claim 15, wherein the step of placing the controller in the active mode includes waiting a pre-determined period of time after key-off.
- [c17] 17. The system of claim 13, wherein the controller determines an ambient air temperature and enables energy flow from the battery to the heater when the ambient temperature is less than a predefined threshold.
- [c18] 18. The system of claim 13, wherein the controller determines battery temperature and enables energy flow from the battery to the heater when battery temperature is less than a predefined threshold.
- [c19] 19. The system of claim 13, wherein the controller de-

termines battery state of charge (SOC) and enables energy flow from the battery to the heater when the battery SOC is greater than a predefined threshold.

- [c20] 20. The system of claim 19, wherein the controller limits energy flow from the battery to the heater based on the battery SOC.